

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Friends of the Cowlitz (FOC) Cowlitz River Sea Run Cutthroat (Lou Reeb's Net Pen)
Species or Hatchery Stock	Sea-Run Cutthroat Trout (<i>Oncorhynchus clarki clarki</i>) /Cowlitz Trout Hatchery
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz/Lower Columbia
Date Submitted	-
Date Last Updated	April 18, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

Friends of the Cowlitz (FOC) - Cowlitz River Sea-Run Cutthroat

1.2 Species and population (or stock) under propagation, and ESA status.

Cutthroat Trout (*Oncorhynchus clarki clarki*)/Sea-Run/Cowlitz Trout Hatchery

ESA Status: In April 1999, NMFS and the USFWS issued a joint proposed rule for the listing of southwestern Washington/Columbia River sea-run cutthroat trout. On July 5, 2002, the USFWS issued a withdrawal of the Proposed Rule to List the Southwestern Washington/Columbia River Distinct Population Segment of the Coastal Cutthroat Trout as Threatened (Federal Register, Vol. 67, No. 129). Not listed and not a candidate for listing at this time.

1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson
	Cowlitz Complex Manager
Agency or Tribe:	Washington Department of Fish & Wildlife
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
Tacoma Public Utilities	Funding Source and Facility Maintenance
Friends of the Cowlitz	Coop Group that operates the Wallace Pond Spring Chinook Net Pen Project and Lou Reeb's Sea Run Cutthroat Net Pen

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources
Tacoma Public Utilities – Total costs at the Cowlitz Salmon Hatchery cannot be broken down specifically for this portion of spring Chinook production.
Friends of the Cowlitz (FOC) – Non profit organization provides in-kind services.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Cowlitz Hatchery Spring Chinook Stock
Broodstock collection location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Adult holding location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Spawning location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Incubation location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Rearing location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz Lou Reeb's Net Pen Site /Cowlitz River/RKm 34.4/Cowlitz

1.6 Type of program.

Integrated Harvest*

1.7 Purpose (Goal) of program.

Fish are specifically for recreational harvest. Release from the Friends of the Cowlitz Net Pen Site (Lou Reeb's property) spreads the sea-run cutthroat program to the lower river.

The goal of the main program at Cowlitz Hatcher Complex is transitioning from recreational harvest to helping recover upper basin populations. In the new Settlement Agreement (SA), this will be done by increasing sea-run cutthroat trout abundance in the Tilton River and upper Cowlitz River (upper Cowlitz and Cispus rivers). This will primarily be achieved by reducing impacts from hatchery releases (after conversion to an Integrated Type Program) and improving fish passage survival through the system. An integrated type program (up to 30%) would be implemented by collecting wild fish for use as a portion of the hatchery broodstock. The program would begin when sufficient numbers of wild fish are available for incorporation as broodstock for the hatchery. In the short term, the release of hatchery smolts larger than 210 mm will produce a return to the hatchery of 5000 fish.

1.8 Justification for the program.

As a 501(c)3 non-profit organization that began on 1988, Friends of the Cowlitz (FOC) is a citizen organization dedicated to work to restore the runs of anadromous fish (salmon, steelhead and cutthroat trout) in the Cowlitz River and its tributaries. Landowners, sports fisherman and other interested parties have worked on the fish and wildlife projects for benefit in the Cowlitz River and several major tributaries. FOC is also involved in net pen rearing projects in the lower Cowlitz River with summer steelhead, spring Chinook, sea-run cutthroat and as part of the resident trout mitigation in Lake Mayfield. This has been possible because of FOC being able to work successfully with the Washington Department of Fish and Wildlife, Lewis County PUD and BPA. FOC has taken a proactive role in Tacoma Power's relicensing of Mayfield and Mossyrock Dams and participated in the initial Conservation Caucus during these proceedings. The Conservation Caucus was a strong advocate for volitional passage, habitat improvements and improved hatchery practices.

Fish transfers to the Lou Reeb's Net Pen site are a portion of the total 160,000 production of the main Cowlitz Trout Hatchery operations. The sea-run cutthroat releases from the lower provide fish for harvest and is designed to spread out the harvest opportunities in lower Cowlitz River. The river downstream of the I-5 area is popular a popular drift with fishing guides as fish may imprint to the release site for a time. A WDFW Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement is used for monitoring the FOC Lou Reeb's cooperative program (see also section 3.2). Sea-run cutthroat releases to the lower river are yearling type smolts at 4.0 ffp.

In order to maximize harvest and identify wild sea-run cutthroat for upper river reintroduction strategies, sea-run cutthroat are 100% adipose clipped. WDFW provides harvest opportunity on the Cowlitz programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) approved by NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

In order to minimize impact on listed fish by the FOC sea-run cutthroat program, the following Risk Aversion are included in this HGMP:

Table 1. Summary of risk aversion measures for the FOC Sea-Run Cutthroat program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	The Net Pen Facility meets the exemption guidelines not requiring the following permits: "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit (>20,000 lbs total on site production and > 5,000 lbs of fish feed per month).
Intake Screening	4.2	
Effluent Discharge	4.2	
Broodstock Collection & Adult Passage	7.9	Not applicable, See Cowlitz River Sea-Run Cutthroat HGMP.
Disease Transmission	7.9, 10.11	<i>Fish Health Policy in the Columbia Basin.</i> Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, <i>Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995).
Competition & Predation	See also 2.2.3, 10.11	Fish are released as smolted yearlings that emigrate from the basin and Columbia river within the year of release. The release location is low in the river and below several miles of potential lower river habitat.

1.9 List of program "Performance Standards".

This is a final acclimation, imprinting and release site and is a transfer of subyearling fish from the main sea-run cutthroat program at Cowlitz Trout Hatchery.

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

Benefits		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Benefits include partnerships and education with local government and local citizens	Friends of the Cowlitz coordinates ongoing and future cooperative projects	Volunteer involvement is tracked yearly and total hours committed are recorded.
Release up to 10,000 fish in smolt condition at the Lower Cowlitz River site.	Contribute to harvest for sport recreational fisheries in the Cowlitz system and achieve contributions similar to smolt-to-adult survival at the Cowlitz Salmon Hatchery.	Survival and contribution to fisheries will be estimated for each brood year released at Cowlitz Trout Hatchery.
Support Upper Cowlitz basin restoration and recovery	Program contributes to sea-run cutthroat goals in the upper Cowlitz.	Adult hauled to the upper Cowlitz are monitored and tracked yearly
Rearing programs operate per Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement	Cooperator reviews and submits MOU to WDFW for each year involved in the project.	WDFW compiles MOU and manages volunteer and partnership program reporting procedures
Individual rearing program sites are highly successful at acclimating and releasing fish from the Lower River site.	Program achieves a 95% survival from transfer to release.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on success of program. WDFW reviews and recommends changes if needed.
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.

Risks		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.
Net Pen rearing units operate in compliance with all applicable fish health protocols.	Fish health documented. Goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stock.	FOC Project lead coordinates and communicate regularly with Region 5 staff. Fish are disposed of properly at a landfill.
Ensure net pen rearing operations comply with state and federal water quality and quantity standards through proper environmental monitoring	<p>MOU Section 4. The Cooperator shall also be responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington.</p> <p>MOU Section 4. The Cooperator is responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington.</p>	The Cooperator complies with all permits required and submits MOU to WDFW for each year involved in the project before project is approved.
Net pen complex placement will not affect spawning behavior of natural populations or pose a substantial risk to listed juveniles.	WDFW staff provides technical site evaluation and operational support to minimize impacts and maximize the success of the program.	The Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details success or operational concerns.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

6.7% of Cowlitz sea-run cutthroat program (431 females spawned (~ 479 need to be collected) with like amount of males).

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	10,000	4.0	March-April	Cowlitz River	Lou Reeb's Net Pens RKm 34.4	Cowlitz	Lower Columbia

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The release of sea-run cutthroat from the Lou Reeb's net pens constitutes approximately 6.7% of the total production released to the lower river. Adults probably contribute to harvest and hatchery escapement but cannot be separated from the main production of the Cowlitz Trout Hatchery (**Table 2**).

Table 2. Sea-run cutthroat plants and percent return.

Year	Smolts Planted	Rack Returns	Percent	Plus 50%*
1990	69,203	1,964	2.66	3,928
1991	106,316	2,404	2.69	4,808
1992	109,645	683	0.52	1,366
1993	96,220	1,279	1.18	2,558
1994	92,381	2,232	2.06	4,464
1995	98,865	3,581	3.53	7,162
1996	82,803	812	1.00	1,624
1997	110,127	1,233	1.11	2,466
1998	140,484	5,763	4.10	11,526
1999	130,800	6,122	4.68	12,244
2000	204,572	11,434	5.59	22,864
2001	228,780	7,583	3.31	15,166
2002	277,662	21,977	0.79	43,954
2003	154,005	9,690	5.80	19,300
2004	96,940	20,733**	21.4	41,546

1.13 Date program started (years in operation), or is expected to start.

The lower river net pen program was involved with some earlier steelhead acclimation and releases, but started sea-run cutthroat rearing in 2001.

1.14 Expected duration of program.

The program is on-going although long-range future production in the Cowlitz system will be based on long range plans for the Cowlitz River (FERC No. 2016, August 2004).

1.15 Watersheds targeted by program.

Cowlitz/Lower Columbia

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues (Part of the main sea-run cutthroat program).

The key issues of the sea-run cutthroat program in regards to ESA listed fish are the impacts of hatchery smolts on listed fish in order to provide a significant lower river fishery. For hatchery sea-run cutthroat, predation, disease and competition along with genetic introgression are impacts on listed fish. There remains concern that the existing hatchery stock which began as a mix of native sea-run cutthroat eggs along with sea-run cutthroat eggs of Beaver Creek stock is separated from wild populations existing in the upper and perhaps lower basin as no wild fish have been incorporated into the broodstock in several generations. Although some Beaver Creek stock was used in the initial culture of the hatchery program and continued into the early to 1970's, subsequent years in the mid-late 1970's utilized wild cutthroat for the program without Beaver Creek influence and are believed to be represented in the current hatchery stock. The sea-run cutthroat trout hatchery program at the Cowlitz Trout Hatchery will be converted to an Integrated Type program as defined by the HSRG. The long-term objective of this program would be to produce 50,000 smolts to meet both conservation and self-sustaining run goals. The hatchery program will terminate upon achieving the self-sustaining run size of 500 adults.

Juvenile monitoring at Cowlitz Falls and Mayfield dams indicates that significant numbers of anadromous sea-run cutthroat trout are still being produced in these basins. For example, during migration years 2000 to 2003, smolt collection numbers at Cowlitz Falls ranged from 967 to 1,323. Thus, based on the low FCE (<50 percent) at Cowlitz Falls Dam, it is likely that the number of smolts passing this project is probably double this range. The production of large numbers of smolts from above the dams is extraordinary given that adult sea-run cutthroat trout were prevented from using these areas for over 30 years (FHMP).

In the short term, the FHMP calls for increasing the survival rate of sea-run cutthroat trout juveniles and adults migrating through the hydroelectric system. Juveniles collected at both Mayfield and Cowlitz Falls dams will continue to be uniquely marked so they may be identified when they return as adults, transported and released into their basin of origin. The run size of both populations will be monitored over time to determine if these populations can be recovered to sustainable levels without human intervention.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: Reduce the program per FHMP proposals A reduction of over 300 percent to 50,000 has been proposed after rebuild (>2008). WDFW has made a proposal to reduce the program to a 100,000 smolt level.

Pros: In the new SA, the Cowlitz Complex facilities will be remodeled by 2008 and the production for all indigenous and non-endemic stock programs are being proposed for reductions (FHMP). In large part, reductions for sea-run cutthroat are proposed in order to reduce the impacts to listed fish. Actual impacts include indirect impacts (predation, competition and genetic introgression) to listed fish from non-endemic stocks. Reducing production might reduce densities in rearing units and provide space for future hatchery programs.

Cons: Reductions are based on reducing indirect potential impacts on listed fish even though specific evaluations have not been conducted. As hatchery production is required to provide adult broodstock for spawning and nutrient enhancement needed for ecosystem productivity, a

reduction in the current program could reduce hatchery production below critical hatchery threshold levels that would result in long term harm to the system. It is unknown if avian or mammal predation that occurs on hatchery smolts would then be shifted 100% to listed stocks in this scenario.

Alternative 2: Eliminate the hatchery program as per FHMP. The long term FHMP goal upon achieving the self-sustaining run size of 500 adults is to eliminate the hatchery plants.

Pros: This would eliminate any potential risks to listed species in the system due to indirect impacts including predation, competition, disease and genetic introgression. Space could be used for further reducing hatchery densities for other programs.

Cons: This alternative is not considered acceptable; currently this program supports a very popular sport fishery and significant economic benefits statewide and the Lower Columbia River region. If the program was eliminated, the goals of the Cowlitz Basin Fish Management Plan (WDFW), Cowlitz Fish Hatchery and Management Plan (FHMP) would not be met. Pressure would be shifted to other rivers less capable of sustaining the fishing effort. It is unknown if avian or mammal predation that occurs on hatchery smolts would then be shifted 100% to listed stocks in this scenario.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: There would be a negative impact region wide to reduce the program 300%. Evaluating the impact would require funding.

Reform/Investment 2: Reducing the program per FHMP proposals would size the program to the new remodel design in order to benefit fish culture rearing parameters to produce high quality smolts.

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

None, although NOAA Fisheries has consulted on the operations of all the fish production activities at these facilities as part of a Columbia River basin wide hatchery biological opinion in 1999 for listings prior to 1998. On March 23, 2004, NOAA Fisheries (Consultation No. 2001/02045) issued a Biological Opinion for the Cowlitz River Hydroelectric Project (FERC No. 2016).

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Identify the ESA-listed population(s) that will be directly affected by the program.

Southwestern Washington/Columbia River Cutthroat Trout (*Oncorhynchus clarki clarki*): Listed in 1999, but petition withdrawn in 2002.

Identify the ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*) are listed as “threatened” under the ESA on May 24, 1999.

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) listed as “threatened” under the ESA on May 24, 1999.

Lower Columbia River Steelhead (*Oncorhynchus mykiss*) listed as “threatened” under the ESA on March 19, 1998.

Lower Columbia River Coho salmon (*Oncorhynchus kisutch*) within the Lower Columbia River/Southwest Washington Evolutionary Significant Unit (ESU) were proposed as threatened under the federal Endangered Species Act in 2004 (NOAA 69 FR 33101; 6/14/2004).

Lower Columbia River Chum salmon (*Oncorhynchus keta*) listed as “threatened” under the ESA on March 25, 1999.

Cutthroat Trout (*Oncorhynchus clarki clarki*): In April 1999, NMFS and the USFWS issued a joint proposed rule for the listing of southwestern Washington/Columbia River sea-run cutthroat trout but later in 2002 issued a withdrawal of the Proposed Rule to List the Southwestern Washington/Columbia River Distinct Population Segment of the Coastal Cutthroat Trout as Threatened. Although not listed, the natural populations are a fraction of historical size and considered depressed (SaSI 2000). In the Cowlitz system, upper basin populations in the Tilton River and Upper Cowlitz will be recovered. According to the criteria listed in the Settlement Agreement, either population will be considered self-sustaining if the R/S value, measured at the Barrier Dam, is greater than 1.0 in three out of five consecutive brood years and the five-year rolling average exceeds an adult abundance level identified by the USFWS. The USFWS has set an interim adult abundance value of 500 (yearly run-size) for both the Tilton River and upper Cowlitz River (1,000 fish total).

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*): Cowlitz Hatchery Spring Chinook are integrated with the Upper Historic population under NOAA’s proposed listing determination (69 FR 33102; 6/14/2004). The current spring Chinook hatchery stock is listed as a core genetic legacy population in the Cowlitz system (Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Natural escapement levels in the lower river below the barrier dam (which include hatchery-origin fish) are typically only 200 to 400 fish (SaSI

2002), although escapement in 2003 and 2004 have increased significantly (**Table 3**). Estimates of adults above Mayfield Dam in the 1960's indicated approximately 9,900 spring Chinook (Serl and Morrill 2004). Currently, significant numbers of adults have been transported the past few years approaching these numbers. Current carrying capacity for spring Chinook smolts in the upper Cowlitz basin is 311,000 smolts (Serl and Morrill 2004). Current productivity in the upper system is approximately 225,000 smolts although less than 40,000 - 45,000 smolts (19%) can be collected at the CFFF (Serl and Morrill 2004). Spring Chinook short and long term objectives for the programs are covered in Section 5.1 (FHMP). Tacoma Power continues to truck adults above the Cowlitz Falls Dam as part of the anadromous reintroduction program.

Table 3. Spring Chinook Abundance Estimates in the Lower Cowlitz River

Year	Lower Cowlitz River	Year	Lower Cowlitz River
1990	320	1998	356
1991	284	1999	285
1992	279	2000	266
1993	236	2001	347
1994	167	2002	419
1995	347	2003	1,937
1996	36	2004	1,793
1997	455	2005	

Source – Lower Columbia Region FMEP 2003 and WDFW Spawning Surveys (2004).

Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*): In 1951, the fall chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951). Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001 the goal had not been met since 1989 (SaSI 2002). In 2002, escapement was 1,427 while 2003 had 10,329 and 4,466 were reported for 2004 (**Table 4**). Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing but adults are taken to the Tilton River.

Coweeman River: Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). SaSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; status today is depressed (SaSI 2002).

Toutle River Fall Chinook. Natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited in WDW 1990). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990).

From 1990–2001, escapement in the South Fork Toutle system averaged 57 fish although significant increases in fall Chinook escapement for 2002 and 2003 reflect the Lower Columbia River trend for those past 2 years.

Table 4. Fall chinook salmon abundance estimates in the Cowlitz System.

Year	Coweeman River	Cowlitz River	Green River	SF Toutle River
1990	241	2,698	123	0
1991	174	2,567	123	33
1992	424	2,489	150	0
1993	327	2,218	281	3
1994	525	2,512	516	0
1995	774	2,231	375	30
1996	2,148	1,602	667	351
1997	1,328	2,710	560	0
1998	144	2,108	1,287	66
1999	93	997	678	42
2000	126	2,700	852	27
2001	646	5,013	4,951	132
2002	891	14,427	7,452	444
2003	1,082	10,329	13,806	137
2004	1,550	4,466	4,108	603

Source – LCR FMEP (2003) up to 2001. 2002 – 2004 data from WDFW database.

Lower Columbia River Steelhead (*Oncorhynchus mykiss*): In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The Cowlitz system had six historical populations including three core (Cispus, Upper Cowlitz, and N.F. Toutle) populations. All are winter steelhead stocks and the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Late winter steelhead have been reintroduced into the upper system (**Table 5**). The Cowlitz system is not surveyed for steelhead (**Table 6**).

Table 5. Late Winter Steelhead Adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked STHD			RV – Right Ventral Clip			AD – Adipose Clip			Totals
	UM-Female	UM-Male	UM-Jack	RV - Female	RV - Male	RV – Jack	AD-Male	AD – Female	AD - Jack	
1996-7	22	12	0	5	14	0	0	1	0	54
1997-8	6	5	0	5	1	0	26	23	0	66
1998-9	15	24	13	10	29	3	6	49	8	157
1999-2000	108	107	0	28	73	0	19	77	0	412
2000-01	133	125	37	71	122	20	70	124	27	729
2001-02	346	419	1	174	492	1	453	898	3	2,787
2002-03	316	205	2	335	241	0	933	497	3	2,532
2003-4	146	146	4	100	167	0	214	619	1	1,397
2004-5										

Source - DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT`

Table 6. Wild winter steelhead abundance estimates in the LCMA.

Brood Year	Index Redd Surveys					Pop. Est. Trap Counts		IndexTrap/redd
	Coweeman	SF Toutle	Green	EF Lewis	Washougal	NF Toutle	Kalama	Cedar Creek
1990	522	752	86	102		36	419	Na
1991		904	108	72	114	108	1,128	Na
1992		1,290	44	88	142	322	2,322	Na
1993	438	1,242	84	90	118	165	992	Na
1994	362	632	128	78	158	90	853	Na
1995	252	396	174	53	206	175	1,212	Na
1996	44	150				251	853	70
1997	108	388		192	92	183	537	78
1998	314	374	118	250	195	149	438	38
1999	126	562	72	276	294	129	562	52
2000	290	490	124	207	939	238	941	Na
2001	284	334	192	79	216	185	1085	Na
2002	Na	Na	Na	Na	Na	Na	Na	Na
2003	Na	Na	Na	Na	Na	Na	Na	Na

Lower Columbia River Coho: Cowlitz Hatchery coho stock are integrated with the Upper and Lower Cowlitz historic population under NOAA's proposed listing determination (69 FR 33102; 6/14/2004). Presently, most Cowlitz River coho are of hatchery origin. Mayfield Dam has blocked tributaries above river kilometer (rkm) 83.2 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton and upper Cowlitz and Cispus rivers. The Washington Department of Fisheries estimated coho escapement at about 32,500 fish in 1951. Coho counts past Mayfield from 1961-66 averaged 24,579. Hatchery-produced returns averaged 24,997 adults and 9,723 jacks in 1980-94 with a peak of 54,685 adults in 1986 and 19,178 jacks in 1987. The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz (**Table 7**) and the Tilton River system since 1996 (**Table 8**).

Table 7. Hatchery Coho adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked Coho			AD – Adipose Clipped Coho			Totals
	UM-Female	UM-Male	UM-Jack	AD - Female	AD - Male	AD – Jack	
1996-7	0	0	0	932	594	629	2,155
1997-8	0	0	0	2,774	1,262	464	4,500
1998-9	0	0	0	4,128	4,140	3,154	11,422
1999-2000	2,398	2,383	120	10,594	11,635	7,197	34,327
2000-01	514	778	284	14,653	16,674	9,566	42,469
2001-02	1,150	1,644	96	15,504	21,564	1,497	41,455
2002-03	3,661	4,688	416	23,698	30,490	6,300	69,253
2003-04	3,477	4,511	484	9,526	11,169	6,143	35,310
2004-05							
Totals	11,200	14,004	1,400	81,809	97,528	34,891	240,891

Source - *DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT*

Table 8. Annual numbers of adult fall Chinook (FCK), coho salmon, winter steelhead (WSH), late Winter Steelhead (LWS), and sea-run cutthroat trout adults transported into the Tilton River system from Cowlitz Salmon Hatchery (CSH) by origin, species, and sex.

Year	Hatchery						Wild				
	Species	Females	Males	Jacks	Non sexed	Total Hatchery	Females	Males	Jacks	Non sexed	Total Wild
1997	FCK	3	24	84		111					0*
	Coho	867	2,766	2,056		5,689					
	WSH	293	289		286	868	8	11			19
	SRCT									79	79
1998	FCK	2	98	141		241					0*
	Coho	903	1,106	1944		3,953	535	647	460		1,642
	WSH	92	158	83		333					
1999	FCK		1	72		73					
	Coho	2,469	3,058	2,471		7,998	573	673	29		1,275
	WSH				339	339		104			104
	SRCT							62			62
2000	FCK		1	636		637					0*
	Coho	4,933	6,138	4,006		15,077	159	252	85		496
	WSH	324	323		7	654	72	47			119
	LWSH						2	6			8
	SRCT										
2001	FCK	397	1,079	1,065		2,541					0*
	Coho	12,569	14,770	1,808		29,147	660	1063	156		1,879
	WSH	214	320	8		542	88	84			172
	LWSH						1				1
	SRCT									92	92
2002	FCK	167	405	16		588					0*
	Coho*	6,165	7,989	1,673		15,827	525	661	69		1,255
	WSH	477	601	3	451	1,532	152	153	1	300	606
	LWSH									12	12
	SRCT									7	7
2003**	FCK	1,968	2,317			4,285					0*
	Coho	3,465	3,341			6,806					617
	WSH					0					84
	LWSH					377					74
	SRCT					0					617
2004**	FCK					1,550					0*
	Coho					12,030					381
	WSH					0					319
	LWSH					503					26
	SRCT										69

Source – Cowlitz Salmon Hatchery annual reports and D. Harmon (2002-2003).

0* Fall Chinook wild/hatchery cannot be determined without mass mark to this point.

** Data for 2003 and 2004 male/female breakdowns not yet available.

Columbia River Chum salmon (*Oncorhynchus keta*) listed as “threatened” under the ESA on March 25, 1999. Chum were reported to historically utilize the lower Cowlitz River and tributaries downstream of the Mayfield Dam site. Typically less than 20 adults are collected annually at the Cowlitz Salmon Hatchery with adults hauled downstream to suitable spawning

habitat areas. In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

Describe hatchery activities: The following hatchery activities are identified in the ESA Section 7 Consultation “Biological Opinion on Artificial Propagation in the Columbia River Basin” (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. No listed fish taken for this program’s broodstock.

Broodstock Program:

Broodstock Collection: Sea run cutthroat can be trapped from late summer through early winter at Cowlitz Salmon and to a lesser extent at Cowlitz Trout Hatchery. Only identified hatchery fish are retained for spawning.

Genetic introgression: There remains concern that the existing hatchery stock which began as a mix of native sea-run cutthroat eggs along with sea-run cutthroat eggs of Beaver Creek stock is separated from wild populations existing in the upper and perhaps lower basin as no wild fish have been incorporated into the broodstock in several generations. Although some Beaver Creek stock was used in the initial culture of the hatchery program and continued into the early to 1970’s, subsequent years in the mid-late 1970’s utilized wild cutthroat for the program without Beaver Creek influence and are believed to be represented in the current hatchery stock.

Rearing Program:

Operation of Hatchery Facilities: See HGMP section 4.2 for water withdrawal, intake screening compliance and hatchery effluent discharges.

Disease: The sea-run population in the hatchery is susceptible to *Ceratomyxa shasta*. Thus, hatchery managers must rear these fish on disease-free water during a portion of their rearing cycle. Although Cowlitz Salmon or Cowlitz Trout Hatcheries have been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

Release:

Hatchery Production/Density-Dependent Effects: Current production is at 10,000 smolts. After rebuild (> 2008) hatchery production of sea-run cutthroat has been reduced to 50,000 smolts. This action is designed to reduce possible predation impacts on listed lower river Chinook populations. Once a level of wild cutthroat reaches a minimum of 500 adults to the upper river, the program has been proposed to ending sea run cutthroat plants. While this is possible, discontinuing the program without being evaluated would be giving up a significant fishery.

Competition: Hatchery sea run cutthroat trout smolts are released from the Cowlitz Trout Hatchery in April at a target size of 8.3 in (up to 216 mm fl); trout at this size generally exhibit smolt characteristics and rapidly emigrate. Competition with, and predation on, other salmonids is likely greater when cutthroat trout smolts residualize (LCFRB Basin Plans 2004). Hatchery cutthroat smolts have the potential to compete for food and space or to prey on juvenile fish in the system, however, competition with native and non-native species in the lower Cowlitz is

considered low but should be evaluated. Tipping (1982) reported that sea-run cutthroat trout released in the Cowlitz River in April were still being caught in significant numbers in August and September as initial migrants. These fish were likely residing in the river until the late summer. As many fish are caught as one year salt fish, they do not reside in sea water for long periods of time and are considered estuary inhabitants. Releasing fish at 4.0 ffp

Predation: Hawkins and Tipping (1999) reported 0.00-2.13% predation rates for sea-run cutthroat. On Chinook fry on the Lewis River, Washington. The predation rates as cited above were associated with extremes in Chinook salmon fry abundance; low predation rates had low spawner densities and high predation rates had high spawner densities. The Lewis River study though correlated predation on the extremely large escapement of fall Chinook produced by that system with substantial increases in predation rates reflecting an increase of nearly 3 times more chinook fry appearing that year from a previous year (Hawkins and Tipping 1999).

Besides individual stock characteristics and abundance of prey, the following Predation Risk Factors have been identified:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Cowlitz River is a large river system averaging 6,664 and 7,490 cfs during April and May (USGS-Real Time average 1934- present). Below I-5, the Toutle River, a large tributary of the Cowlitz River adds another 2,000 – 2,600 cfs to the system.

Dates of Releases: Steelhead are released mid-April to May 1st. Listed fish can be present in some part of the timing of the steelhead release.

Relative Body Size: Predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length or larger in aquarium environments (Pearsons et al. 1998). The “33% of body length” criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the “33% of body length criterion” until further data for individual rivers can be collected.

Release Location and Release Type: The release from the Cowlitz Trout Hatchery is to the lower river at Rkm 66.1. This is below the upper river productivity. It is likely that a significant portion of migration and dispersal of the hatchery program occurs before peak emergence of listed winter steelhead. Although the release is not totally volitional, most fish quickly vacate the pond as soon as screens are removed.

Residualism: To maximize smolting characteristics and minimize residual sea-run cutthroat, WDFW adheres to a combination of acclimation, release strategies, and size at release (4.0 ffp), and conditions that based on past history indicating smolt characteristics and emigrate rapidly. Condition factors including a leaner .90-.99 K factor close to release.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor especially for an estuary type life cycle fish.

Monitoring:

Associated monitoring Activities: In the new SA, interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat

and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis, and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Broodstock taken for this program does not take listed fish, therefore take tables will not be submitted with this HGMP.

In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities.

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist who along with the Complex Manager would determine an appropriate plan and consult with NOAA if needed.

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. Hood Canal Summer Chum Conservation Initiative) or other regionally accepted policies (e.g. the NPPC Annual Production Review Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and Chinook in the ESU.

For ESU-wide hatchery plans, the sea-run cutthroat production from Cowlitz Trout Hatchery was described in the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin and the 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Current production numbers can vary from past productivity levels and reflect reductions in programs due to ESA concerns.

Hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. The following is a list of guidelines, policies and permit requirements that guide WDFW Columbia hatchery operations:

- *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington.*
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
- *Spawning Guidelines for Washington Department of Fisheries Hatcheries.*
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).
- *Stock Transfer Guidelines.*
- *Fish Health Policy in the Columbia Basin.*
- *National Pollutant Discharge Elimination System Permit Requirements*

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003). The new thirty-five year license was issued March 13, 2003, and became effective on July 18, 2003. Tacoma Power has contracted with the Washington Department of Fish

and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.

- The Cowlitz Fish Hatchery and Management Plan (FHMP) is part of the new Settlement Agreement (Article 6).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

3.3 Relationship to harvest objectives.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Pacific Fisheries Management Council, *US v. Oregon*, and other state, federal, and international legal obligations. Besides ocean fisheries, specific harvest objectives will vary depending on the phase of the reintroduction and recovery program.

Sea-run cutthroat are harvested in a variety of freshwater sport fisheries in Washington. Although cutthroat are commonly caught in marine fisheries in Puget Sound, few are harvested from the Pacific Ocean. Therefore, the ocean harvest of Cowlitz River fish taken is inconsequential. Commercial fisheries in the mainstem Columbia River are precluded from retaining incidentally encountered cutthroat. Expansion of selective fisheries designed to protect naturally produced salmon should result in an increased level of protection for all cutthroat. Further, most returning cutthroat are too small to be retained in commercially fished nets.

Sport fisheries selective for adipose fin-clipped cutthroat is expected to occur in the mainstem Columbia River and the lower Cowlitz River on a year round basis with a goal of maximum removal of hatchery origin fish. Fisheries directed at the harvest of Cowlitz River sea-run cutthroat operate in the lower Columbia River and in the Cowlitz River downstream of the Barrier Dam. Sport fisheries occur in the lower Columbia and Cowlitz year round. Exploitation rates are not known but could be part of the monitoring program developed for this plan. All HOR cutthroat are adipose clipped. Only adipose clipped fish can be retained in sport fisheries (i.e. all wild fish are required to be released).

3.3.1 Describe the fisheries benefiting from the program, and indicate harvest levels and rates for program origin fish for the last twelve years (1988-99), if available. See also Section 1.12.

Fisheries benefiting from this program will include:

- Columbia River Zone 1-3 recreational fishery
- Lower Cowlitz River recreational fisheries

Fisheries directed at the harvest of Cowlitz River sea-run cutthroat operate in the lower Columbia River and in the Cowlitz River downstream of the Barrier Dam. Sport fisheries occur in the lower Columbia and Cowlitz year round. Exploitation rates are not known. All sea-run cutthroat trout with an intact adipose fin would have to be released in all fisheries throughout the Cowlitz River basin and only HOR cutthroat are adipose clipped and can be retained in sport fisheries (i.e. all wild fish are required to be released). Commercial fisheries in the mainstem Columbia River are precluded from retaining incidentally encountered cutthroat. Expansion of selective fisheries designed to protect naturally produced salmon should result in an increased level of protection for all cutthroat. Further, most returning cutthroat are too small to be retained in commercially fished nets.

3.4 Relationship to habitat protection and recovery strategies.

Along with Tacoma City Light, Lewis River PUD, federal and local government agencies, and local citizens, both technical and policy WDFW personnel participate on a number of habitat protection and recovery strategies in the Cowlitz basin. Key areas of habitat protection and restoration priorities are identified along with strategies to help recover salmonid populations in lower river tributaries or the Upper Cowlitz system. Upper Cowlitz River reintroduction and nutrient enhancement programs have used returns to the Cowlitz Hatcheries as key components in

the recovery strategies.

The following processes have been key for habitat protection and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) and along with long term re-licensing agreements with Tacoma City Light:

Sub-Basin Planning

Cowlitz system habitat protection and recovery strategies in the Columbia River and tributaries have been part of Subbasin Planning processes funded by the Northwest Power Planning Council. Recent regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990. A more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the regional recovery plan. *The Lower Columbia fish Recovery Board (LCFRB)* has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection

Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA)

A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven subbasins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

Cowlitz River Hydroelectric Project Re-licensing Settlement Agreement (FERC 2016). A number of Articles dealing with habitat issues have been included in the Settlement: The Fish Habitat fund (Article 11) in the amount of \$3.0 million before January 18, 2004, the date required by the License. Upon license issuance, Tacoma Power implemented the in-stream flows as prescribed by this article – In-stream flows (Article 13). Ramping Rate Conditions - Tacoma Power has implemented the ramping rates as prescribed by Article 14. The Cowlitz River Fisheries and Hatchery Management Plan (FHMP) Final of August 2004 was Prepared by Tacoma Power to fulfill Article 6 of the Settlement detailing the short range and long range goals of reintroduction and recovery of upper basin indigenous stocks along with hatchery production goals and operations below the barrier dam. The FHMP was built using the concepts and modeling tools inherent in the Ecosystem Diagnosis and Treatment (EDT) methodology and the hatchery production guidelines developed through the Northwest Power Planning Council Artificial Production Review and Evaluation (APRE) process. The APRE process was initiated in response to a Congressional directive to the Northwest Power Planning Council. Building upon the principles and criteria provided by the Hatchery Science Review Group (HSRG) in the *Scientific Framework for Artificial Propagation of Salmon and Steelhead* (HSRG 2002), the APRE identifies hatchery operating procedures that maximize the benefits of artificial production programs while minimizing the risks to natural populations.

Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833)

Although not part of this Project, Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833), constructed in 1994, is the uppermost dam on the mainstem Cowlitz River. It is located just upstream from the headwaters of Riffe Lake and forms the 11-mile-long Lake Scanewa. The mainstem Cowlitz River flows unimpeded above Lake Scanewa (the lake formed by the Cowlitz Falls project) and below Mayfield Dam.

3.5 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* There are high numbers of predators in Mayfield and Riffe Lake Reservoirs, such as northern pikeminnow and rainbow trout, as well as exotic predators, such as tiger muskies, brown trout, large and smallmouth bass, bluegill, crappie, and yellow perch introduced for angling. These predators present a risk to smolts migrating through the lakes or juveniles rearing in the lakes from reintroduction programs. Once below the reservoirs, smolts can be preyed upon through the entire migration corridor from release to the mainstem Columbia River estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can predate on chinook smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Based on PIT tags recovered at a large Caspian Tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids from the Columbia reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1998). River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, other hatchery fish may be a source of competition for Cowlitz chinook.

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run chinook salmon ESU (threatened); Snake River spring/summer-run chinook salmon ESU (threatened); Lower Columbia River chinook salmon ESU (threatened); Upper Columbia River spring-run chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.*

Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system. There are no species that are known to directly positively impact the program. Multiple hatchery programs salmonids releases into the Columbia river system along with listed species (section 2), benefit the program by providing additional predation opportunity

in the Columbia mainstem and estuary. Numerous non-salmonid fishes sculpins, lampreys and sucker etc. also would provide the same indirect benefits.

4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrophic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Nutrient Enhancement and biomass Needs for the upper Cowlitz system are discussed in section 3.6.1(FHMP).

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile and natural limitations to production attributable to the water source.

For rearing at Cowlitz Trout Hatchery see Cowlitz River Sea-Run Cutthroat HGMP.

The Lou Reeb's Net Pen site was sited in order to be out of the mainstem flow of the Cowlitz River and is situated adjacent to private property. Fish are taken to the net pen site in late February or early March. Fish are imprinted and acclimated to the lower river site for approximately 45 days before release in mid-April. Ambient temperatures range from the low 40 ° F to the low 50s° F during the rearing period and flows of the Cowlitz River range from 5,000 – 10,000 cfs during this timeframe.

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

The net pen mesh keeps program fish enclosed during the rearing period. Listed fish would not normally be attempting to enter the pen through the mesh although the size 5/8 –3/4 inch stretch would allow small fish. The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit and the production from this facility falls below the minimum production requirement for an NPDES permit.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

The Cowlitz Trout Hatchery has an adult trapping and holding facility that includes a weir and fish ladder in Blue Creek. Adult hold facility consists of three adult ponds @ 10' X 150' X 5'. Fish are hand sorted and handled according to the Cowlitz Complex Adult Fish Handling Protocol. Fish are returned to the river via truck from this facility.

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam across the Cowlitz River with an associated fish ladder with significant attraction features. The effective length of the barrier weir crest is 318 feet. The fish ladder supplies fish to the sorting, transfer and holding facilities. Adult fish to be transported are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

The main attraction feature of the Cowlitz Salmon Hatchery fish ladder is located above the barrier dam adjacent to the fish ladder. It diverts a significant amount of attraction water into the mouth of the fish ladder. This diversion has a bar screen with 7/8 in. clear rack bar spacing. Gravity intake control is achieved by use of a vertical slot weir equipped with a motor operated closure gate. This unit has no screening. An auxiliary vertically-slot entrance is provided at the left bank end of the barrier dam for the purpose of attracting fish from the left bank area to the transport area under the barrier and subsequent movement to the ladder facilities.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	-	-	-	-
5	Concrete Ponds	10000	100	20	5.0	2000

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

Adult fish, and occasionally juveniles, that are to be transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

Juvenile fish being released or transferred between facilities utilize the above trucks and the 1,500 gallon fish tanker assigned to the Cowlitz Trout Hatchery. All vehicles have juvenile and adult handling capability. They all have oxygen and recirculating systems. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon fiberglass tank and several 250 gallon tanks) are utilized for moving fish around and between the facilities. The 1,500 gallon tanker assigned to the trout hatchery has a hydraulic loading boom for loading adults from the trout hatchery adult ponds.

5.3 Broodstock holding and spawning facilities.

The Cowlitz Trout Hatchery has three adult holding ponds @ 10' X 150' X 5'.

Fish collected at the Cowlitz Salmon Hatchery for broodstock are held in ponds that are 20' X 100' X 5.5'. From the fish ladder separation facility fish can be sorted to two of these ponds. Broodstock can be transferred to a number of other ponds via direct pond to pond transfer or by handling, after anesthesia, in the spawning room and returning to a chosen pond via a return tube.

At the Cowlitz Trout Hatchery fish are sorted, if mature and needed for spawning, to a holding area in one of the adult ponds. From this holding area the females are killed and placed on a drying rack out of the pond. After the eggs are taken, males are netted up and placed into a small holding container into which carbon dioxide is diffused. Once the males are anesthetized, they are live spawned and then returned to the pond. 23 (1.7%) 13 (1.9%) 10 (1.5%)

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Shallow Trough (2 tier) with incubation baskets	16	3.5-5.0	7.165/trough	20000 (5 baskets per trough)	21000 (1 basket per trough)

5.5 Rearing facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
6	Concrete Raceways	2000	80.0	10.0	2.5	330	1.25	0.20
24	Concrete Raceways	5340	100	20	2.67	1000	1.0	0.25
3	Earthen Pond 5.0-Acres	185600	1450	160	8.0	4000	2.5	0.0027
1	Earthen Pond 2.0 Acre Lake	111360	870	160	8.0	4000	2.5	0.0054

The Cowlitz Trout Hatchery has 88 shallow trough incubators, 6 fry raceways @ 10' X 90' X 2.5', 24 raceways @ 20' X 90' X 2.5', 3 five acre lakes, one 2.5 acre lake and three adult holding ponds @ 10' X 150' X 5'. The river intake is able to supply 50 cfs of river water or 20 cfs while the ozone plant is operating. The well pumps are capable of supplying an additional 5 cfs. The ozone plant is the first one designed specifically for hatchery use. This plant is capable of producing 200 pounds of ozone daily.

5.6 Acclimation/release facilities.

See section 10.2.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

Sea-run cutthroat are very sensitive to *Ceratomyxa shasta* and it has caused some significant fish mortality in the past. Installation of a ozone treatment facility in 1994 has decreased mortality significantly. The de-nitro towers deteriorated and caused significant gas bubble disease problems during the 1999-2000 incubation phase.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Safeguards to insure a uninterrupted water supply at the Cowlitz Trout Hatchery include auxiliary power to supply two of the four river water intake pumps, the north well and the ozone plant. All water sources and head boxes of all raceways are equipped with low water alarms. The water intake structure also has an alarm for the river water, south well water and the north well water. All wells and river pumps are also alarmed. The river water is a source of numerous pathogens. This water is disinfected by the ozone plant during the warmer rearing months. Since water is reused between numerous ponds the possibility for the spread of infection is inherent at the facility. Normal fish culture hygiene is practiced. Flooding and muddy water occasionally occurs even though the river level is controlled by three dams. Fish are not reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds. One of these generators has sufficient capacity to operate the two-200 hp pumps and two of the 600 hp pumps along with the residences in the event of a power outage. A new 1.5 KBW generator with upgraded switching equipment was also installed in 1999. The new generator is capable of supplying the power previously supplied by the three previous generators combined. Tacoma Public Utilities has retained the 600 KW generator and switching equipment in case the new generator should ever fail. Tacoma Public Utilities staff maintains the facility. Tacoma Public Utility staff and Washington Department of Fish and Wildlife Staff test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. At the stress relief ponds, water is stored in empty ponds for flushing in case fish need to be released due to lack of flow. Also, a water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxillary power is being used.

Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss. The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Net pens have been sited to minimize flood problems.

Section 6. Broodstock Origin and Identity

6.1 Source.

Adult hatchery-origin sea-run cutthroat returning to the Cowlitz River Trout Hatchery.

6.2.1 History.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Cowlitz River Sea-Run Cutthroat	N	1968	U
Cowlitz Trout Hatchery Sea-Run Cutthroat	H	1971	Present

A mix of native sea-run cutthroat eggs along with sea-run cutthroat eggs of Beaver Creek stock were used in the initial culture of the hatchery program. Although this mixed practice continued to 1975, subsequent years in the mid-late 1970's utilized wild cutthroat for the program without Beaver Creek influence and are believed to be represented in the current hatchery stock.

6.2.2 Annual size.

All broodstock are from marked hatchery-origin fish released from and returned to the Cowlitz Trout Hatchery (or Salmon Hatchery Fish Collection Facility when needed). Fish returns have been large the past several years. See section 1.12.

6.2.3 Past and proposed level of natural fish in the broodstock.

Since the mid 1970's, wild cutthroat were utilized in the program up to 1983 when releases were adipose clipped. In the early 1980's, approximately 20% of the cutthroat catch was estimated to be wild fish (Tipping 1981). Since marking in 1983, only hatchery marked fish have been used.

6.2.4 Genetic or ecological differences.

There remains concern that the existing hatchery stock which began as a mix of native sea-run cutthroat eggs along with sea-run cutthroat eggs of Beaver Creek stock is separated from wild populations existing in the upper and perhaps lower basin as no wild fish have been incorporated into the broodstock in several generations. Although some Beaver Creek stock was used in the initial culture of the hatchery program and continued into the early 1970's, subsequent years in the mid-late 1970's utilized wild cutthroat for the program without Beaver Creek influence and are believed to be represented in the current hatchery stock.

6.2.5 Reasons for choosing.

This stock is chosen to provide harvest opportunity by having a long history of success in the hatchery program in the Lower Columbia Region especially once the water supply minimized *Ceratomyxa Shasta* disease problems.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

- Only hatchery identified fish are used.
- Holding pond procedures follow IHOT guidelines.
- Other listed fish, if identified, will be released immediately if encountered during the broodstock collection process.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2 Collection or sampling design

Fish are collected from ~ July 1 through January at the Cowlitz Trout Hatchery or Cowlitz Salmon Hatchery. Fish are sorted at the Cowlitz Trout Hatchery as infrequent as possible to avoid unnecessary stress. Prior to spawning season all collected fish are sorted by species, sex, new, previously recycled, natural (unmarked) and either returned to river, saved or placed in a resident water depending on policy. There is no selection criteria for size and all fish are randomly selected for spawning. Natural (unmarked fish) are currently not used for spawning. Fish selected for spawning are primarily those sexually mature in November through February. Sea run cutthroat spawning normally begins the first week of December and concludes by the end of December.

7.3 Identity.

All hatchery-origin sea-run cutthroat are adipose-fin clipped. Natural fish are returned to the river.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):

862 total. Approximately 431 pairs are needed. Fecundity can vary considerably from 650 – 1,000 eggs per female.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Adults	
	Females	Males
Planned	431	431
1995	942	942
1996	1957	1631
1997	246	246
1998	346	346
1999	524	514
2000	471	463
2001	1114	1080
2002	493	567
2003	463	445
2004	371	349

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Adults surplus to hatchery needs can be marked with an opercule punch and returned to the river for additional sport opportunity or transported to Riffe Lake.

7.6 Fish transportation and holding methods.

Fish are held in trap (100' x 10') until sorted weekly. Then desired fish are placed into separate sections of a holding raceway. Sections are divided by picket racks. Fish are then sorted weekly to determine ripeness.

Adult fish that are to be transported from the Cowlitz Salmon Hatchery fish separation unit are held in one of six 643 cubic feet circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds of fish. There are two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river or to the Cowlitz Trout Hatchery adult holding ponds.

7.7 Describe fish health maintenance and sanitation procedures applied.

Formalin treatments were administered every other day during the adult-holding period.

7.8 Disposition of carcasses.

Spawned carcasses of sea-run cutthroat are considered inedible. Carcasses are buried. Presently no carcasses are provided for nutrient enhancement, primarily for disease (IHNV) concerns

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

There will be no selection for size and all fish will be randomly selected for spawning. Currently, (unmarked fish) will not be used for spawning.

Section 8. Mating

8.1 Selection method.

Adults are collected from July 1 through December. Sea run cutthroat spawning normally begins the first week of December and concludes by the end of December. Normally there are at least 4 or 5 separate egg takes.

8.2 Males.

Males are randomly selected for each days spawning at a 1:1 ratio. Males can be terminated during spawning but more often live stripped and then made available for additional sport opportunities in both then lower or upper river system (Riffe Lake).

8.3 Fertilization.

When spawning activities occur, females are lethal spawned while the males are anesthetized with carbon dioxide and live spawned in anticipation of future spawning purposes and/or enhance the sport fishery.

Beginning with the 2001 brood spawning (December 2000), all spawning is one male to one female. Sperm is added to eggs from one female and after five minutes, the fertilized eggs are disinfected and water hardened in an iodine solution for one hour. After the one hour period, the eggs are combined into 5 fish pools and placed in shallow troughs to incubate.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

An iodophor solution is used to rinse hands and spawning implements between handling and spawning of each spawning pair. Individuals spawned are randomly selected and there is no selection for size. Spawning occurs over a course of several weeks. Natural, unmarked fish, will not be used for spawning.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1995	510,000	NA	NA
1996	528,000	NA	NA
1997	184,500	80.6	NA
1998	311,400	72.8	NA
1999	411,200	68.8	NA
2000	370,400	62.5	NA
2001	864,000	67.4	NA
2002	439,316	91.7	NA
2003	421,288	NA	NA
2004	431,357	NA	NA

Egg take goal is 267,000 green eggs although a surplus can be taken.

NA- Not available at this time. Data will be filled in before submittal to NOAA.

9.1.2 Cause for, and disposition of surplus egg takes.

A surplus of eggs have been held in past years to accomplish two goals: 1) to provide a larger gene pool and 2) to provide insurance against losses due to disease (C. shasta and IHN) and predation. If surplus still occurs over and above program needs, eggs are destroyed.

9.1.3 Loading densities applied during incubation.

Eggs from five fish are incubated per basket (in shallow trough) until eyed then 20,000 - 21,000 eggs per trough for hatching. Egg size varies from 3,250 to 3,500 per pound

9.1.4 Incubation conditions.

Oxygen levels, flows and temperatures are monitored.

9.1.5 Ponding.

At 10 days after swim up (volitional), in trough, fish are fed when they are about 2,000 fish per pound (fpp). Ponding occurs when fish are from 1,500 fpp to 600 fpp depending on pond space. Lengths are not measured. Ponding begins in mid-February continuing into May. The procedures used for determining when fry are ponded include: Fry are ponded based on visual inspection of the amount of yolk remaining. First ponding generally takes place during the first week of March.

9.1.6 Fish health maintenance and monitoring.

Salmon fungus (*Saprolegniasis*) is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators. Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No listed fish will be incubated with the beginning of mass marking for the 1997 brood spring chinook. Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on site.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1995	510000	NA	NA
1996	528000	NA	NA
1997	184500	80.6	NA
1998	311400	72.8	NA
1999	411200	68.8	NA
2000	370400	62.5	NA
2001	864000	67.4	NA
2002	439,316	91.7	NA
2003	421,288	NA	NA
2004	431,357	NA	NA

NA – Not available at this time. Will be filled in before submittal to NOAA.

9.2.2 Density and loading criteria (goals and actual levels).

Fish are started in concrete troughs with 6.9 cubic feet of water capacity loaded with an average of 20,000 fry. Water flow in troughs is 10 gallons per minute (gpm). Rearing containers are concrete raceways of either 10' X 90' or 20' X 90' and 5.0 or 2.5 acre rearing ponds. The 10" wide raceways are started with up to 200,000 fish at 1,500 fpp. Twenty-foot wide raceways are started with 400,000 fish maximum at 700 fpp. Water is one-time pass through in the ten foot wide raceways, but is re-use water in the 20 foot wide raceways. As fish increase in size the numbers are reduced to a final loading number of 35,000 -40,000 fish per 20 foot wide raceway. Ten foot wide raceways are not used at final grow out. Rearing ponds receive fresh and previously used water. Loading is 350,000 fish in the 5.0 acre lakes and 150,000 fish in the 2.5 acre lake.

9.2.3 Fish rearing conditions.

Oxygen levels are normally greater than 10 ppm in incoming water. Temperatures range between 40-54 degrees Fahrenheit at both facilities. The program does NOT use a diet and growth regime that mimics the natural seasonal growth patterns. Ponds are cleaned, on average, every other day throughout their rearing. Effluent from cleaning goes into a pollution abatement pond.

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
February (At Ponding)	NA	2500	NA	
March	NA	900	NA	0.640
April	NA	400	NA	0.556
May	NA	150	NA	0.625
June	77.9	80	4.054 E-04	0.467
July	98.7	40	4.259 E-04	0.500
August	130.2	18	4.125 E-04	0.300
September	151.7	12	4.115 E-04	0.444
October	164.7	10	4.267 E-04	0.167
November	169.9	9.0	4.059 E-04	0.100
December	175.9	7.0	4.298 E-04	0.222
January	185.8	6.0	4.258 E-04	0.143
February	195.1	5.5	4.412 E-04	0.083
March	196.2	5.0	4.093 E-04	0.083
April	208.2	4.0	4.539 E-04	0.200

9.2.5 Indicate monthly fish growth rate and energy reserve data (average program performance), if available.

Feeding rates are followed so that fish size is within 10% of program goal each year. Feed is stored under proper conditions as described by IHOT guidelines. See also 9.2.4.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Swimup-Fry	Mash/#0	7	3.0-4.0		0.5
Fry	#1 and #2 crumble	7	3.0-4.0		0.7
Fingerling	1.2 mm and 1.5 mm	7	1.5-2.5		0.9
Yearling	2.0 mm	5	1.0-1.5		1.3
Smolt	2.5 mm	57	1.0-1.5		1.5

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring	Health and disease monitoring is done by pathologists currently budgeted for the Cowlitz Complex. Policy guidance includes: <i>Fish Health Policy in the Columbia Basin</i> and <i>Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	<i>Renibacterium salmoninarum</i> , the pathogen that causes BKD in salmonids, is passed from the adult via the egg stage to the juvenile fish. <i>R. salmoninarum</i> is also transmitted by the water borne route, among fish in the rearing ponds as well as from the hatchery water supply. Fry and fingerling undergo ELISA segregation during rearing, as well as oral prophylactic treatments with Erythromycin. In the standard ponds, fry and fingerlings have been treated with Florinicol for Bacterial Cold Water Disease (BCWD) and Paracide-f for external parasites, fungus and <i>trichodina</i> control on holding adults. Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low level chronic mortalities during the rearing period. Erythrocytic inclusion body syndrome has occurred in many years and predisposes fish to other diseases, such as bacterial kidney disease (BKD), fungal infections and BCWD. Frequently it occurs concomitantly with these diseases. Formalin baths were also given after marking to prevent cold-water disease and fungus from infecting the clipped area. Fish health and or treatment reports are kept on file.
Sanitation	Mortality is collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by behavior, physical appearance and other criteria.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

Comparisons of raceway reared and rearing pond (dirt/gravel bottom) reared fish have shown that cutthroat reared in ponds have twice the survival of fish from raceways.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

The sea-run population in the hatchery is susceptible to *Ceratomyxa shasta*. Thus, hatchery managers must rear these fish on disease-free water during a portion of their rearing cycle. Because disease-free water is limited, the reduction in program size would increase the amount available for rearing listed native late winter steelhead. When juveniles are culled, it is NOT done randomly over all segments of the population.

Section 10. Release

10.1 Proposed fish release levels.

Current FBD is for 10,000 smolts annually.

10.2 Specific location(s) of proposed release(s).

Lou Reeb's Net Pen is located at Rkm. 34.4 approximately 1.0 mile upstream of the confluence of the Toutle River with the Cowlitz River.

10.3 Actual numbers and sizes of fish released by age class through the program.

Lou Reeb's Net Pen Releases

Year	Smolts Planted	Size Yearlings
2003	13,000	4.0
2004	10,123	4.0

10.4 Actual dates of releases and description of release protocols.

Fish have been reared in net pens anchored in the lower Cowlitz River. Two separate transfers and releases can be made, one in April and one in May. Approximately 5,000 are transferred at a time.

10.5 Fish transportation procedures, if applicable.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1500	Y	N	30-60	NA	NA
Tanker Truck (1)	750	Y	N	30-60	NA	NA
Tanker Truck (1)	1000	Y	N	30-60	NA	NA

Fish are transferred from Cowlitz Trout Hatchery to the net pen site in the tankers above.

10.6 Acclimation procedures (*methods applied and length of time*).

Fish are reared in the net pens for approximately 30-45 prior to release. Fish seem to imprint to this lower release site as fishing pressure guides congregate to this area heavily (pers. comm. Don Glaser).

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels

Only a set program number as identified in the FBD will be transferred to the Lou Reeb's Net Pen site. .

10.9 Fish health certification procedures applied pre-release.

Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

10.10 Emergency release procedures in response to flooding or water system failure.

The net pens would elevate within the river due to flooding and would not pose a problem unless debris threatens the net pen. Net pen material allows water exchange even in flooding conditions. If necessary, a release a short time in advance of a release date could occur especially if fish are at size.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

- The sea-run population in the hatchery is susceptible to *Ceratomyxa shasta*. Thus, hatchery managers must rear these fish on disease-free water during a portion of their rearing cycle.
- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations
- Fish are acclimated for several weeks at the site before release.
- Also, innovative rearing techniques proposed in the settlement hatchery remodel will incorporate semi natural aspects of fish culture including protective pond coloration along with overhead and in-water cover on an experimental basis.
- Fish not reaching smolt guideline size are not released. Fish are planted in Riffe Lake if it is determined that they would not reach size by release in the spring.

Current levels of hatchery production in the Cowlitz River Basin are undergoing ESA consultations between NOAA Fisheries and the WDFW. Artificial propagation activities in this license that will be proposed as part of the FHMP, the Remodeling and Phase-In Plan, and the Disease Management Plan, 19 will undergo a separate ESA consultation as these plans are not developed enough to give a clear understanding of the proposed action on which to consult. Any future hatchery consultation will be in the overall context or to meet the goal of reestablishing self-sustaining population levels consistent with a viable ESU scenario. In other words, viable populations of spring chinook salmon and a contributing population of steelhead will need to be established above the Project. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted, pursuant to which NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species. This section generally considers the direct and indirect effects to listed species that may result from hatchery mitigation actions.

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

In addition to the regional monitoring activities associated with this program, see section 2.2.3-Monitoring, the Cowlitz Hatchery evaluation Biologist monitors and evaluates the following factors associated with this hatchery program: Condition Factor of hatchery spring chinook smolts prior to release, Smolt-to-Adult survival rates of hatchery spring chinook releases, Freshwater harvest levels for hatchery program releases. In association with upper Cowlitz watershed recovery efforts, the Cowlitz Hatchery evaluation Biologist also operates the smolt trap at Mayfield Dam. This trap receives emigrating juveniles generated from plants and natural production in the Tilton River watershed.

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia). Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall Chinook juveniles to estimate survival has also begun on the lower river.

The completion of the Surface Collection System and Fish Facilities at the Cowlitz Falls Dam in 1996 marked the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 linear miles of historically productive habitat in the upper Cowlitz and Cispus watersheds. Since then, WDFW funded by Tacoma Power, has monitored productivity of spring Chinook, late winter steelhead, coho and cutthroat trout. Fish Collection Efficiency (FCE) is monitored by mark-recapture of steelhead, coho and age-zero spring chinook smolts that are marked with visible implant elastomer tags.

The Cowlitz River Fisheries and Hatchery Management Plan is a component of the Cowlitz Hydroelectric Project Settlement Agreement with a large component of monitoring and evaluation for the upper basin recovery. Currently monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile out-migration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Tacoma Public Utilities funds the staffing and support logistics for the program monitoring and evaluation. Staffing is comprised of and derived from a pool of personnel used in fish cultural and pathology related tasks.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

Section 12. Research

12.1 Objective or purpose.

See Cowlitz Sea-Run Cutthroat HGMP.

12.2 Cooperating and funding agencies.

12.3 Principle investigator or project supervisor and staff.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

12.6 Dates or time periods in which research activity occurs.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

12.8 Expected type and effects of take and potential for injury or mortality.

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).

12.10 Alternative methods to achieve project objects.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities.

Section 13. Attachments and Citations

13.1 Attachments and Citations

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Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Certified by _____ Date: _____